THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 112. APRIL 1867.

XXXVI.—*Note on the Excavating Sponges; with Descriptions of four new Species.* By ALBANY HANCOCK, F.L.S.

[Plates VII. & VIII.]

SINCE the publication of my paper on the excavating Sponges*, I have reexamined nearly all the species therein described, and have carefully investigated several new and interesting forms from various parts of the world; and, as a result of these researches, I have only become more confirmed in the opinion that these lowly organized creatures are endowed with the power (of whatever nature it may be) of forming in shell and other hard calcareous bodies the crypts and channels within which they lie concealed. The means by which this work is achieved is still, I frankly admit, involved in much obscurity.

Shortly after the appearance of the paper above alluded to, I satisfied myself that the larger bodies found in contact with the surface of *Cliona celata* were not organically connected with it, as I originally thought, but were really nothing more than decalcified portions of the horny membranous tissue of the oyster-shell within which the *Cliona* was buried; and some time ago I wrote to Dr. Bowerbank to this effect†. If, therefore, *Cliona* works out the cavities it inhabits in the manner I supposed, namely, mechanically, it must be by the aid of the smaller bodies described in my paper, or by the spicula themselves.

My object, however, on the present occasion is not to discuss the means by which *Cliona* excavates its habitation, but rather to give some additional specific characters that distinguish the British species, and which originally escaped observation. But in the first place it must be stated that Dr. Bowerbank is not exactly correct when he asserts, as he has done in the second

* Ann. & Mag. Nat. Hist. ser. 2. vol. iii. p. 321, May 1849.

† On the 28th of February, 1866.

volume (p. 216) of his recently published 'Monograph of the British Spongiadæ,' that I have divided Dr. Johnston's *Halichondria celata* into twelve species. It does not appear that Dr. Johnston ever saw any one of the species described by me; there is certainly nothing in his description to show that he had examined more than one form of *Cliona**. Neither do I see any reason for believing that Dr. Bowerbank himself has enjoyed any greater advantage; for if he had had in his possession specimens of my species, he assuredly would never have written that "nearly all these proposed new species have the same habit and the same forms of spicula, with only such an amount of variation in size and form as may readily be found in a single field of view beneath the microscope in any well-known specimen of *Halichondria celata* of Johnston, when mounted in Canada balsam"†. Now I have numerous slides, so mounted, of *Cliona celata*, Grant, which species is undoubtedly the same as Johnston's second variety under that specific denomination, and I have never found on any of them more than one form of spiculum, or any of the forms that characterize *Cliona Northumbrica*, *C. gracilis*, *C. Howsei*, *C. Alderi*, *C. corallinoides*, *C. lobata*, or *C. vastifica*; neither have I, in any of these species, found the exact form of spiculum that distinguishes *C. celata*. In fact the habit of the sponge and the characters of the spicula are so well pronounced that, with the exception of one, which I admit to be critical, few naturalists, after a careful examination of the species I have described, will doubt their distinctness.

And here it may be observed that the study of *C. celata* alone is not sufficient for the full comprehension of the questions connected with the excavating Sponges. This species is not by any means typical of the group: it has but one form of spiculum, while by far the greater number have two or three kinds, and the sponge itself does not assume in a decided manner that lobed structure which is so dominant among the species. All the British forms should be carefully examined; and the foreign, which are very abundant, should be investigated with equal assiduity. When this is done there will be little difference of opinion on most questions connected with the subject.

When I drew up the descriptions of the species, I had not

* This, however, does not appear to have been Dr. Johnston's own opinion. In a letter I had the pleasure of receiving from that excellent naturalist shortly after the publication of my paper on *Cliona*, speaking on this subject he says, "I have no doubt my *C. celata* embraces several species." But this was a hasty utterance, written on the spur of the moment, and probably meant nothing more than an expression of his conviction that there are more than one species of British *Cliona*.

† Monograph of the British Spongiadæ, vol. ii. p. 216.

mounted any of the spicula in balsam; it was not till some time afterwards that this was done, and the discovery made that a third minute form of spiculum had been overlooked in several of the species. It was unfortunate that this had escaped observation in the first instance, as it aids materially in distinguishing the species, though the characters originally given appear amply sufficient for the purpose.

Cliona celata possesses only pin-like spicula, according to all writers on the subject; and it is equally true that most of the *Clionæ* have likewise pin-like forms: but in very many instances they have also associated with them other forms; and it is such association of various kinds of spicula that chiefly characterizes the species, and that distinguishes most of those I have described from *C. celata*. Dr. Bowerbank, however, denies the existence of a second kind of spiculum, fusiform or "acerate," in any of the British species*. This distinguished naturalist believes the fusiform spicula described by me to be adventitious, adhering accidentally to the surface of the sponge. Such belief is perfectly untenable. The fusiform spicula are not attached to the surface, as assumed by the Doctor, but are imbedded throughout the substance of the sponge in vast numbers; they are certainly numerically equal to the pin-like form, as is stated to be the case in the original description of *C. corallinoides* and *C. Canadensis*. There is no more reason for supposing the fusiform spicula to be adventitious than there is for assuming the pin-like forms themselves to be so; both kinds undoubtedly belong to the organism. It may also be stated that numerous foreign species examined by me have similar fusiform spicula associated with the pin-like form; and in many instances there is likewise present the third minute kind already mentioned as occurring in several of the British species. But even when only the pin-like spicula are found, they are usually sufficiently characteristic to distinguish the species; when, however, this form is, as just stated, associated with other kinds of spicula, there can rarely be any doubt on the subject.

All the three forms of spicula are found in each of the membranes of the sponge. In such species as *C. Northumbrica*, *C. corallinoides*, and *C. vastifica* the pin-like form is the least numerous, being only sparingly distributed in the internal membranes, though they are densely crowded in the papillæ, where they are arranged longitudinally in parallel order, with the heads mostly in one direction; so that when the papillæ are flattened or retracted, they assume a radiating disposition. The fusiform spicula are in vast numbers in connexion with the external and

* *Op. cit.* vol. ii. p. 216.

internal membranes, and occur also in the papillæ, where they are frequently arranged transversely. The minute spicula are found everywhere, but in the greatest number in the external membrane, particularly on the papillæ; they are sometimes crowded together in vast multitudes. In the species which have only pin-like spicula, these spicula equally pervade all the membranes; but I have not observed that they assume any definite arrangement in the papillæ, though in *C. globulifera*, one of the species described in the sequel of this paper, which has only the pin-like form, they are occasionally arranged in a radiating manner in the internal membranes. Thus it appears that, in some instances at least, *Cliona* does show a limited degree of order in the distribution of the spicula.

It must not, however, be supposed that the spicula supply the only characters that distinguish the species: the colour of the sponge must also be taken into account, as well as the size, number, and distribution of the papillæ; the general habit and mode of branching, or, in other words, the size and character of the burrows containing the sponge are highly characteristic. But here, again, we are unfortunately at issue with Dr. Bowerbank, who asserts that these burrows are made by "lithodomous Annelids"*, and consequently the branching of the sponge must be accidental, being entirely dependent for its character on the form of the cavities within which the sponge is lodged, being moulded, in fact, in worm-burrows. I shall not here reiterate the facts and arguments brought forward in my former paper to refute such an opinion. It may, however, be asked how it is that, while *C. celata* is found in vast abundance on our coasts, inhabiting excavations in shells and limestone, the worm or annelid assumed to have made the cavities has never yet been determined. Surely, if these are worm-burrows, we ought naturally to expect to find the maker of them, as frequently at least as *Cliona*, in peaceable undisputed possession of its habitation. But no, *Cliona* alone occupies these cavities; no worm has yet been taken that the naturalist can pronounce to have made them. Then why not allow *Cliona* to be the fabricator, as it is the constant possessor, of its excavated home?

Dr. Bowerbank, indeed, mentions "several" instances of having found Annelids occupying the "numerous sinuous canals" in large *Balani* from the Guliot caves in Sark, and also of finding "living Annelids in deeply seated portions of the perforations in the limestone boulders of Tenby"†. There is nothing surprising in this; in fact we might have expected such instances to occur much more frequently to a naturalist

* *Op. cit.* vol. ii. p. 221. † *Ibid.*

of Dr. Bowerbank's experience. Many worms and other marine animals conceal themselves in any hole or crevice they can find, and numerous worms or annelids perforate both shells and limestone and other hard calcareous bodies. Living worms occupying their own burrows in these substances are frequently met with; and it is not uncommon to find such burrows in shells perforated by *Cliona*, and mingling in the most intricate manner with the excavations of the latter. But there is never any difficulty in determining which was made by the worm and which by the sponge. And if the instances mentioned in the 'Monograph of the British Spongiadæ' are genuine worm-burrows, neither can there be, in these cases, any uncertainty as to the fact of their being so.

Worm-burrows are always linear, usually cylindrical, and are more or less tortuous; they never assume a dendritic form, are sometimes double, or as it were bent upon themselves, and a little flattened; the surface is invariably smooth, never punctured or shagreened, as it is in the burrows of *Cliona*, the excavations of which, on the contrary, are always dendritic, dividing dichotomously, anastomosing, usually constricted at intervals by perforated septa, so as to form a congeries of small chambers, and having the surface constantly punctured or shagreened, and generally giving off on every side numerous delicate cæcal tubes.

To account "for the vast number of perforated *shells*, and the comparative rareness of the Annelids," it is suggested, in the work on the British Spongiadæ before quoted*, that the worms assumed to have made these perforations obtain their nutriment by passing the excavated substance, "abounding in animal matter," through the digestive organs, the analogy of the earthworm being relied on. Unfortunately, however, for the advocacy of such an idea, the excavations inhabited by *Cliona* are of the same character and equally extensive in *limestone*. Whatever made these burrows in the one material also made them in the other; of this there can be no doubt; and yet it would be very hard to believe that these hypothetical worms would be able to derive much nutriment from limestone, however much they might obtain from shell. This fact, indeed, sufficiently disproves the nutritive theory; and the difficulty still remains with those who assume the agency of worms, to account for the great number and vast extent of the excavations occupied by *Cliona*, and the almost entire absence of worms.

But there is another equally formidable obstacle in the way of attributing these excavations to worms, and which appears to be perfectly insurmountable. In all the excavations

* Vol. ii. p. 220.

occupied by *Clionæ* there are numerous circular orifices opening at the surface of the shell or stone containing the parasite; now the papillæ or oscula of the sponge, communicating with the water, always protrude through these apertures, and invariably correspond to them in size, number, and position, leaving no orifice unoccupied, and exactly fitting each, whether there be upwards of two hundred to the square inch, as in *C. vastifica*, or only about twenty-five or less, as in *C. celata*. How are we to account for such a fact as this, if it be maintained that these orifices were drilled by worms? Are we to consider that this complete correspondence between these parts of the sponge and the orifices is a mere chance coincidence—wonderful, indeed, if true? or that the worm made the openings purposely, in strict accordance with the requirements of the sponge that on some future day might take up its abode in the deserted excavation? or is it that the sponge has the power of modifying the position, number, and size of these important organs to meet the circumstances of its usurped home? The first two propositions cannot be entertained for a moment, and the last is contradicted by the fact that *C. vastifica* is never found with few and large papillæ, like *C. celata*; nor in the latter species are they ever very numerous and minute, as is the case with the former. And, indeed, the arrangement, size, and number of the papillæ are good specific characters throughout the genus.

If we now refer to what is stated in my former paper on the subject, already quoted, and at the same time take into account what is advanced on the present occasion, we shall find that the following facts seem to be sufficiently demonstrated. And they certainly appear cogent enough to satisfy the most scrupulous inquirer that *Cliona* excavates for itself its abode in hard calcareous bodies:—

1. That the sponge, when examined in a good state, is always found to fill every part of the excavation, even to the minutest ramification.

2. That the excavations are as frequently in limestone as in shell.

3. That no worm has been found that can be pronounced to have made these excavations, and that worms are rarely or never taken in them.

4. That these excavations have no resemblance whatever to the burrows of worms.

5. That the surface of the excavations inhabited by *Clionæ* is always shagreened or punctured in a peculiar manner, while that of the burrows of worms is always smooth.

6. That *Clionæ* with the papillæ of the same size, number,

and arrangement, and with the same kind of spicula, always occupy similar burrows.

7. That the oscula or papillæ always correspond in size, number, and position to the external orifices in the surface of the shell or stone enclosing the sponge.

8. That *Cliona* has been traced through every stage of growth, from the microscopic gemmule adding branch after branch and lobe after lobe, to the fully developed sponge, excavating step by step its complicated abode in sound transparent shell*.

Cliona undoubtedly works out the cavities it inhabits, whether mechanically or otherwise. Whatever the process may be, the difficulty in believing that a sponge, even if deprived of all mechanical agency, can burrow into hard substances is much lessened since I first wrote on the subject. It has recently been ascertained that some of the Polyzoa bury themselves in hard calcareous bodies, as does also *Lagotia viridis*, a minute and feeble animalcule†; and it is now well known that certain unicellular *Fungi* live immersed in the shells of mollusks and in other hard calcareous bodies‡. And, surely, since such is the case, since plants, without motion or any mechanical aid, work out for themselves crypts and channels in hard shell, there can be no difficulty in the way of believing in the possibility of a sponge forming its habitation within substances of the same nature. And it is interesting to observe how similar the ramifications of these Fungi are to those of *Cliona*, the resemblance being so close in many instances as to lead to the idea that they might prove to be microscopic sponges, had we not the high authority of Kölliker for believing in their fungoid nature.

Before concluding these few remarks, a word or two may be said on a certain relation that appears to exist between *Cliona* and the Foraminifera. All the excavating Sponges display a lobed structure, some of them to a very remarkable degree. The lobes are usually angulated, sometimes more or less rounded, and are always connected together by exceedingly short constricted stems into branches which, dividing dichotomously, anastomose, the division and anastomosis usually going on to such an extent that the sponge ultimately becomes a congeries of small lobes. Now the sarcode of the Foraminifera is generally composed of a series of similar lobes, which are united in like manner by short constricted stems, or "stolons," as they are called, only differ-

* Ann. & Mag. Nat. Hist. ser. 2. vol. iii. p. 327, pl. 14. fig. 4.

† Described by Strethill Wright, M.D., in Edinburgh New Philosophical Journal, new series, vol. vii. p. 276.

‡ "On the frequent occurrence of Vegetable Parasites in the hard structures of Animals," by Prof. Kölliker, Ann. & Mag. Nat. Hist. ser. 3. vol. iv. p. 300, Oct. 1859.

ing from *Cliona* in the fact that they are usually arranged either spirally or cyclically, and do not assume a regularly branched character; but nevertheless the arrangement of the lobes in the two groups is occasionally very similar.

If we remove the testaceous covering of any of the *Rotalinæ*, and suppose the sarcode unrolled, we shall see at once how much the structure resembles a branch of *Cliona corallinoides*, for instance: both are composed of a series of nodules or lobes united by very short constricted stems. The sarcode of *Nodosaria*, however, requires no unrolling to exhibit this relationship; but it will be best understood on comparing the figures of the various species illustrating my paper before referred to on the excavating Sponges with the many instructive figures of the sarcode given in Dr. Carpenter's 'Introduction to the Study of the Foraminifera,' published by the Ray Society. On examining the representation of the cast of the chambers of *Orbitoides Fosteri* therein given from Ehrenberg*, it is seen that the chambers or lobes are arranged cyclically; but in a radial direction they assume a branched distribution; and if we trace the connexion of the lobes (Pl. VII. fig. 8) from the centre to the circumference, beginning with those next the primordial lobe, we can easily observe not merely that they are connected into branches by delicate stems, but that these branches divide dichotomously and anastomose very much in the same manner as do those of *Cliona*. Indeed the structure appears to be essentially the same in both, differing only in the fact that in *Orbitoides* the lobes, in addition to a branched, partake of a cyclical arrangement.

Should this similarity in the structure of the Foraminifera and *Cliona* be anything more than a mere vague analogy, spicula might be expected to occur in some species of the former; and accordingly such seems to be the case. A few years ago Dr. J. E. Gray discovered spicula in a new generic form designated by him *Carpenteria* †; and at the time he commented on the fact as proving the connexion supposed to exist between the Foraminifera and Porifera: it is possible, however, that these spicules may be parasitic. It would therefore seem likely that there is something real in the relationship pointed out; and, indeed, when we recollect that the *Clionæ* are among the lower-organized Sponges, their intimate connexion with the Foraminifera is what might be looked for.

I shall now close these few remarks with emended descriptions of the spicula of the British *Clionæ*, and with full descriptions

* Pl. 22. fig. 2.

† Proceedings of the Zoological Society, pt. xxvi. p. 266, April 27, 1858.

of four new foreign species. The characters of the additional spicula in the former are put in italics, so that the reader may see at a glance what is now added.

Cliona celata. Pl. VII. fig. 7.

Spicula pin-like, long and stout, a little fusiform and somewhat bent, measuring upwards of $\frac{1}{50}$ of an inch in length; the head is well defined, globular, approaching to ovate, with generally a terminal obtuse point, being placed not exactly at the end of the shaft.

Cliona gorgonioides.

Spicula pin-like, large and stout, measuring $\frac{1}{94}$ of an inch long; the head oval, and frequently at some little distance from the extremity; thence the shaft gradually tapers to the other or pointed end, and is usually much bent, particularly towards the head, and sometimes the pointed extremity is a little recurved.

This is a critical species, and is probably a mere variety of *C. celata.*

Cliona Northumbrica. Pl. VII. fig. 1.

Spicula of three kinds. The 1st much the largest, measuring $\frac{1}{77}$ of an inch in length, is pin-like, straight, sharp-pointed, with the head large, round, and terminal: the 2nd kind is fusiform, scarcely more than one-fourth the length of the first, rather stout, much and suddenly bent in the centre, with both ends sharply pointed, and when viewed through the $\frac{1}{6}$th-of-an-inch object-glass is seen to be minutely spinous: *the 3rd form is very minute, being not more than* $\frac{1}{1800}$ *inch long; it is cylindrical, bent sharply in the centre, and apparently smooth under the* $\frac{1}{6}$*-inch object-glass, though occasionally there are slight indications of spines; the extremities are recurved, slightly enlarged, and rounded.*

The second and third forms are more numerous than the first, which is most abundant in the papillæ.

When dry, the sponge is of a pale, clear ochreous-yellow colour. Since the publication of my former paper, a few additional specimens have occurred on the Northumberland coast, and one in an oyster-shell, probably from Scotland.

Cliona vastifica. Pl. VII. fig. 2.

Spicula of three kinds. The first pin-like, $\frac{1}{87}$ inch in length, straight, rather slender, and diminishing imperceptibly to a very fine point at one end, the other terminating in a perfectly globular head: the second kind is about one-third the length of the first, and is much thinner; it is stoutish in the centre, where it rather suddenly bends a little, and thence tapers gradually towards the ends, which are sharply pointed; it is

throughout minutely spined; but in some instances the spines are sufficiently strong to be observed with the $\frac{1}{4}$-inch object-glass: *the third form is* $\frac{1}{2100}$ *inch long, cylindrical, irregularly bent or angulated once or twice, occasionally three times; it has a central angle, and is strongly spined; the extremities are obtuse.*

Several specimens have recently occurred in oyster-shells, but the locality is not known. When dry the sponge is of a yellowish-white colour. There are both large and small papillæ in this species; the former are three times the size of the latter, and are scattered at wide intervals among the others.

Cliona corallinoides. Pl. VII. fig. 3.

Spicula of three kinds. The first, $\frac{1}{70}$ inch long, is pin-like, slender, generally bent in the centre, tapering gradually to a sharp point at one end, and at the other furnished with a well-defined elliptical head: the second kind is scarcely one-third the length of the first; it is fusiform, very delicate, and suddenly bent in the centre, and when observed with the $\frac{1}{6}$-inch object-glass is seen to be minutely spined; the extremities are sharply pointed: *the third form is minute, being only* $\frac{1}{2000}$ *inch long; it is spinous, with the extremities obtuse, and is generally zigzagged, having three angles, one being in the centre.*

A year or two ago Mr. H. T. Mennell obtained at Guernsey a specimen of this species in a valve of *Pecten maximus*. The dried sponge is of a brown colour.

Cliona gracilis. Pl. VII. fig. 4.

Spicula of three kinds,—the first pin-like, about $\frac{1}{77}$ inch long, generally a little bent, stout, and inclining to fusiform, with the pointed end gradually tapering; head rounded, somewhat elliptical, and merging imperceptibly into the shaft; the second kind is fusiform, one-third the length of the first, less stout, and gradually bent in the centre; it is minutely spined, and has the extremities sharply pointed: *the third form is about* $\frac{1}{1500}$ *inch long, and is usually zigzagged so as to form four or five angles; it is most minutely spined, and has the extremities rounded and recurved.*

When dry, the sponge is of a yellowish-brown colour.

Cliona Howsei. Pl. VII. fig. 5.

Spicula of three kinds,—the first pin-like, about $\frac{1}{100}$ inch long, very delicate, generally straight, with the head broadly ovate, short, well-marked, terminal, and having the narrow end at the extremity, and sometimes a little prolonged: the second form is abundant and generally somewhat longer than the first; it is equally slender, mostly slightly bent, and gradually diminishes to

a fine point at one extremity; the other has usually two heads—one terminal or nearly so, the second about one-third down the shaft; the terminal head is frequently wanting: *the third form is about* $\frac{1}{600}$ *inch long, rather stout, cylindrical, usually irregularly bent or angulated, and strongly spined, with the extremities obtuse.*

A few additional specimens have occurred on the Northumberland coast. The sponge, when dry, is of a pale yellow-ochre colour.

Cliona Alderi.

Spicula of two kinds,—the first pin-like, $\frac{1}{110}$ inch long, moderately thick, slightly bent, with a small head near one end, and tapering to the other extremity; the second form is scarcely shorter than the first, and has one end truncate, the other pointed, and is decidedly bent in the centre.

Sponge, in a dried state, of a yellowish-brown colour.

Cliona lobata. Pl. VII. fig. 6.

Spicula of two kinds,—the first $\frac{1}{100}$ inch long, not very slender, mostly a little bent, and brought gradually to a sharp point at one end, the other with an irregularly rounded head, sometimes slightly elliptical, and generally not exactly terminal: *the second kind, which is* $\frac{1}{300}$ *inch long, is cylindrical, rather stout, arched, and zigzagged, being six or seven times angulated; it is strongly spined, particularly at the angles; the extremities are obtuse.*

I am indebted to Mr. Charles Adamson, of Newcastle-upon-Tyne, for the second specimen I have seen of this very distinct species: it is in the shell of an oyster obtained from the rocks on the west coast of Scotland. The dried sponge is of a dark snuff-colour.

After a careful perusal of the above descriptions of the spicula, few naturalists, I believe, will doubt the existence of more than one species of British excavating Sponge.

The foreign species, which are undoubtedly very numerous, exhibit a considerable variety of spicula, though the prevailing forms are similar to those found in the British species. A few have only the pin-like kind, in this respect resembling *C. celata*; but by far the greater number have either two or three kinds, as in *C. lobata* and *C. Northumbrica*. The following descriptions are of four well-marked foreign species that have recently come under my notice:—

Cliona vermifera. Pl. VIII. fig. 2.

Sponge, when dry, of a pale yellow-ochre colour; branches

crowded and confused, composed of numerous series of irregular elongated lobes about $\frac{3}{10}$ inch wide, which communicate with each other by constricted stems; papillæ not numerous, varying in size, the largest about $\frac{1}{12}$ inch wide. Spicula of two kinds: one, $\frac{1}{100}$ inch long, is pin-like, unusually stout, mostly a little bent, with the head terminal, broadly ovate, the wide extremity in connexion with the shaft; the other form, which is scarcely one-fourth the length of the pin-like kind, is rather stout, cylindrical, arched, worm-like, undulated frequently three or four times, with the extremities obtuse. Both kinds are numerous.

Two specimens of this well-marked species have occurred, both in a species of *Chama* in my cabinet. The spicula are very characteristic. I have met with no other species which has the undulated or worm-like kind; and the stout shaft and broadly ovate head of the pin-like form are very striking. The surface of the excavations is strongly shagreened, and exhibits a few scattered punctures.

Cliona Mazatlanensis. Pl. VIII. fig. 1.

Sponge, when dried, of a soiled brown or pale drab-colour, made up of a vast number of minute lobes about $\frac{1}{10}$ inch wide, irregularly rounded, united by very short constricted stems, and so crowded that the mode of branching is perceptible only at the margin of growth, where it is seen to be dichotomous, the terminal twigs being rather short, delicate, and obtuse; papillæ very numerous and minute, distributed without apparent order, $\frac{1}{30}$ inch wide; there are a few larger ones scattered amidst the others, and about three times their size. Spicula of three kinds: the first is pin-like, $\frac{1}{175}$ inch long, with the shaft straight, delicate, and gradually tapering to a fine point at one end, the other exactly terminated by a large oval head, within which a cavity is distinctly seen; the second kind is fusiform, about half the length of the former, most minutely spined, pretty regularly arched, and with both ends sharply pointed; the third form is quite minute, not more than $\frac{1}{1300}$ inch long, cylindrical, sharply bent in the centre, roughened or minutely spined, and with the extremities obtuse.

I have seen but one specimen of this species: it has overrun the entire surface of a *Purpura* from Mazatlan, presented to the Newcastle Museum by Dr. P. P. Carpenter. The surface of the burrow is strongly shagreened.

Cliona globulifera. Plate VIII. fig. 3.

Sponge of a pale clear yellow colour when dry, composed of numerous globules or rounded lobes, about $\frac{1}{3}$ inch wide, united by short, cylindrical, more or less constricted stems, and so

crowded that the usual dendritic character is scarcely discernible; the terminal twigs are excessively short, and there are very few spine-like processes; papillæ few and large, measuring sometimes as much as $\frac{3}{20}$ inch in diameter. Spicula pin-like, $\frac{1}{88}$ inch long, usually straight, occasionally a little bent, tapering gradually to the pointed extremity; the head oval, mostly placed a considerable way from the end, which is rounded; frequently the head is almost obsolete, sometimes entirely wanting; and two heads are not by any means uncommon, one placed a little below the other.

A finely developed specimen of this species has penetrated the shell of *Spondylus gæderopus* from the Mediterranean. It is allied to *C. celata*, as is evinced by there being only one kind of spiculum, and that pin-like. The form of this organ, however, is sufficiently characteristic; but perhaps the colour of the sponge, the delicacy of its texture, and the lobulated mode of its growth are the best distinguishing features.

Cliona Carpenteri. Pl. VIII. fig. 4.

Sponge, when dry, of a pale yellowish colour, formed of numerous crowded angulated lobes scarcely $\frac{3}{20}$ inch wide, each united to its neighbours by two or three short, much constricted, cylindrical stems; papillæ about $\frac{1}{20}$ inch in diameter, not very numerous, varying little in size, and scattered without apparent order. Spicula of three kinds,—the first pin-like, $\frac{1}{100}$ inch long, straight, slender, rarely a little bent, with the head distinct, perfectly globular, and exactly terminal: the second kind, which is half the length of the first, is fusiform, unusually stout, with occasionally an indistinct narrow nodule in the centre, where it is suddenly bent; the extremities are very sharply pointed: the third form is very minute, being only $\frac{1}{2000}$ inch long; it is usually straight, slightly fusiform, a little bent, and strongly spined, with the extremities obtuse.

Only one specimen of this species has been obtained; it occurs in the shell of a *Serpula* adhering to a *Chama* from Mazatlan, presented to the Newcastle Museum by Dr. P. P. Carpenter.

EXPLANATION OF THE PLATES.

Plate VII.

Fig. 1. Spicula of *Cliona Northumbrica*: *a*, pin-like spicula; *b*, fusiform ditto; *c*, the minute or third form of ditto.
Fig. 2. The minute or third form of spicula of *C. vastifica*.
Fig. 3. Ditto of *C. corallinoides*.
Fig. 4. Ditto of *C. gracilis*.
Fig. 5. Ditto of *C. Howsei*.
Fig. 6. The minute or second form of spicula of *C. lobata*.

Fig. 7. Spicula of *C. celata.*

Fig. 8. A few of the cells of *Orbitoides Fosteri,* from Dr. Carpenter's figure, after Ehrenberg : *a,* cell next primordial cell ; *b, b,* stolons or stems uniting the cells.

Fig. 9. A portion of an undescribed *Cliona* immersed in the shell of *Pecten Magellanicus* : *a, a,* lobes of the sponge corresponding to the cells in fig. 8 ; *b, b,* stolons or stems.

PLATE VIII.

Fig. 1. Spicula of *Cliona Mazatlanensis* : *a,* pin-like spicula ; *b,* fusiform ditto ; *c, c,* minute or third form of ditto.

Fig. 2. Spicula of *C. vermifera* : *a,* pin-like spicula; *b, b,* the second or worm-like ditto.

Fig. 3. Ditto of *C. globulifera.*

Fig. 4. Ditto of *C. Carpenteri* : *a, a,* pin-like spicula ; *b,* fusiform ditto ; *c, c,* the third or minute form of ditto.

XXXVII.—*On the Young Stages of a few Annelids.*

By ALEXANDER AGASSIZ.

[Concluded from p. 218.]

POLYDORA, *Bosc* (*Leucodora,* Johnst.).

Claparède having given, in his 'Beobachtungen,' a very complete history of the development of what he calls *Leucodora ciliata,* the following observations would be superfluous as far as they relate to new phases in *Polydora,* but may be useful in clearing up the confusion existing concerning the identity of *Leucodora,* Johnst., and *Polydora,* Bosc. Quatrefages, in his Synoptic Table*, has introduced these two genera as distinct, and separates them on account of the remarkable structure of the bristles of the fifth ring in *Polydora,* which he says is not to be found in *Leucodora* : this must evidently be a mistake, as Johnston's figure† certainly possesses the peculiar bristles of the fifth ring, as maintained by Claparède in his 'Beobachtungen.' Yet, notwithstanding this correction of Quatrefages by Claparède ‡, in his review of the system proposed by the former, and the accurate description given by him (Claparède), in Müller's 'Archiv'§, of *Polydora cornuta,* we find him associating with the genus *Polydora,* in his embryology of *Leucodora ciliata,* a genus which is certainly not *Polydora* as he himself has limited it, but may be a species of *Spio* or *Nerine,* or per-

* "Note sur la Classification des Annélides," in Comptes Rendus, 27 March, 1865 (Annals, ser. 3. vol. xvii. pp. 1, 107).

† "Miscellanea Zoologica," in Mag. Zool. Bot. 1838, ii. p. 66.

‡ Bibliothèque universelle de Genève, Avril 1865. [Annals, ser. 3. vol. xvii. p. 100.]

§ "Ueber *Polydora cornuta,* Bosc," in Archiv für Anat. u. Phys. 1861 p. 542.